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IS 4545-1 (2008): Methods of measurement on receivers for television broadcast transmissions, Part 1: General considerations [LITD 7: Audio, Video and Multimedia Systems and Equipment]

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भारतीय मानक

टेलिविजन प्रसारण ट्रांसमिशन के लिये रिसीवर मापन की पद्धतियाँ

भाग 1 सामान्य प्रयोजन

(दूसरा पुनरीक्षण)

Indian Standard

METHODS OF MEASUREMENT ON RECEIVERS FOR TELEVISION BROADCAST TRANSMISSIONS

PART 1 GENERAL CONSIDERATIONS

(Second Revision)

ICS 33.160.020

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

July 2008 **Price Group 10**

Audio, Video and Multimedia Systems and Equipments Sectional Committee, LITD 07

FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Radio Communication Sectional Committee had been approved by the Electronics and Information Technology Division Council. The Division Council in its eighth meeting reconstituted the Radio Communication Sectional Committee (LITD 20) as Audio, Video and Multimedia Systems and Equipments Sectional Committee (LITD 07).

This standard is largely based on IEC Publication 60107-1 (1997) 'Methods of measurement on receivers for television broadcast transmissions: Part 1 General considerations' issued by the International Electrotechnical Commission.

The object of this standard is to lay down the general conditions of measurements to be used for testing of a receiver for television so as to make possible the comparison of the results of measurements. Limiting values of the various quantities for acceptable performance are not specified in this standard but would be covered in separate standards.

The first version of IS 4545 which was published in 1968, covered the methods of measurements for television broadcast receivers having monochromes vision reception. With the introduction of colour television receivers, this standard was first revised in 1983 to make it applicable to receivers designed for both monochrome and colour vision receptions and published in a number of parts to deal with different aspects of characteristics of television receivers. Now, this revision is being undertaken to align the standard with the latest international practices dealing with methods of measurements on television receivers as given in IEC 60107-1: 1997.

The other parts in the series are as follows:

Part 2 Tuning properties and general measurements
Part 3 Geometric properties of the picture
Part 4 Synchronizing quality
Part 5 Sensitivity
Part 6 Selectivity and response to undesired signal
Part 7 Fidelity
Part 8 Compatibility with audio-visual recording equipment
Part 9 Electrical and acoustic measurements at audio frequency
Part 11 Measurement under conditions different from broadcast signal standards
Part 12 Electrical measurements on multi-channel sound television receivers using the NICAM two channel digital sound system

For television broadcast in India, the standard system B (the 625 line standard) of the International Radio Consultative Committee (CCIR) has been adopted. For colour transmission the PAL B system with a sub-carrier of 4.43 MHz has been adopted. The characteristics of the system B of CCIR are given in IS 11453 : 1985 'Characteristics of systems for monochrome and colour television'.

The methods of measurements for safety requirements for television receivers and procedures for radiation measurements area covered by IS 616 : 2003 /IEC 60065 : 2001 'Audio, video and similar electronic apparatus — Safety requirements' and IS 10052 (Part 2) : 1999 'Specification for radio disturbances and immunity measuring apparatus and methods: Part 2 Methods of measurement of disturbances and immunity (*first revision*)' respectively.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard

Indian Standard

METHODS OF MEASUREMENT ON RECEIVERS FOR TELEVISION BROADCAST TRANSMISSIONS

PART 1 GENERAL CONSIDERATIONS

(Second Revision)

1 SCOPE

This standard (Part 1) specifies general conditions for measuring the electrical properties as applied to broadcast television receivers designed for monochrome and colour vision reception with accompanying sound according to systems and standards adopted in India.

2 REFERENCES

The following standards are necessary adjuncts to this standard.

IS No.	*Title*
12552 : 1999/ CISPR 20:1998	Sound and television broadcast receivers and associated equipment immunity characteristics — Limits and methods of measurement
9000 (Part 1) 1988	Basic environmental testing procedures for electronic and electrical items: Part 1 General

3 TERMINOLOGY

For the purpose of this standard the following definitions and explanations of terms shall apply.

3.1 Signal Strength — The signal strength is considered to be equal to the rms value of unmodulated radio frequency signal having the same peak envelope amplitude as that of the modulated television signal at peak amplitude.

3.2 Voltage and Current — These imply in television technique 'peak-to-peak' values; this is indicated by p-p. Without such indication, voltage and current imply rms values, unless otherwise specified. A fully modulated radio frequency signal is a radio frequency signal modulated to white level in accordance with the standard of the television system used. By convention, the signal strength is considered to be equal to the rms value of an unmodulated radio frequency signal having the same peak amplitude as the modulated signal has at the peak of modulation. This corresponds to white level for systems using positive modulation and synchronizing level for systems using negative modulation as shown in Fig. 1A and Fig. 1B.

NOTES

1 Greater modulation depths may occur with colour signals (*see* **3.3** and **3.4**).

2 The true rms values of a modulated signal will be different from this value, the magnitude of the difference depending on the depth of modulation and its waveform. In the tests in which a sinewave modulated carrier may be used, the factor for conversion to peak values is given in the appropriate figures.

3.3 Picture Modulation Percentage — Picture modulation percentage is expressed on a linear scale to indicate the picture signal level at any given instant.

Zero percent modulation corresponds to the black level, and 100 percent picture modulation corresponds to the white level as defined for the system used. Values below 0 percent and above 100 percent may occur with colour signals. Intermediate values correspond to intermediate levels of the picture signal (*see* Fig. 1A and Fig.1B).

3.4 Envelope Level — The envelope level is expressed on a linear scale to indicate the level of the vision radio-frequency signal at any given instant.

100 percent envelope level corresponds to highest carrier level for a monochrome signal, and 0 percent envelope level corresponds to the zero carrier level.

With negative modulation, 100 percent envelope level corresponds to the radio-frequency signal level at the tip of the synchronizing pulses. With positive modulation 100 percent envelope level corresponds to the radio-frequency signal level at white level (100 percent picture modulation) (*see* Fig. 1A and Fig.1B). This value may be exceeded for colour signals.

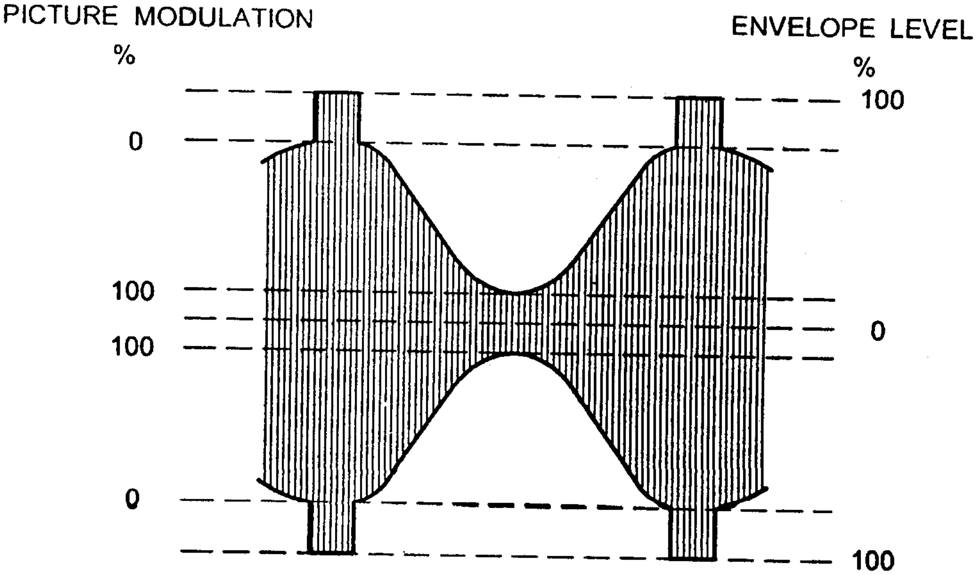
3.5 Luminance — Luminance (L) in a given direction is the luminous intensity per unit of projected area of any surface as viewed from that direction.

The luminance value is expressed in candela per square metre (1 cd/m^2 = 1 unit).

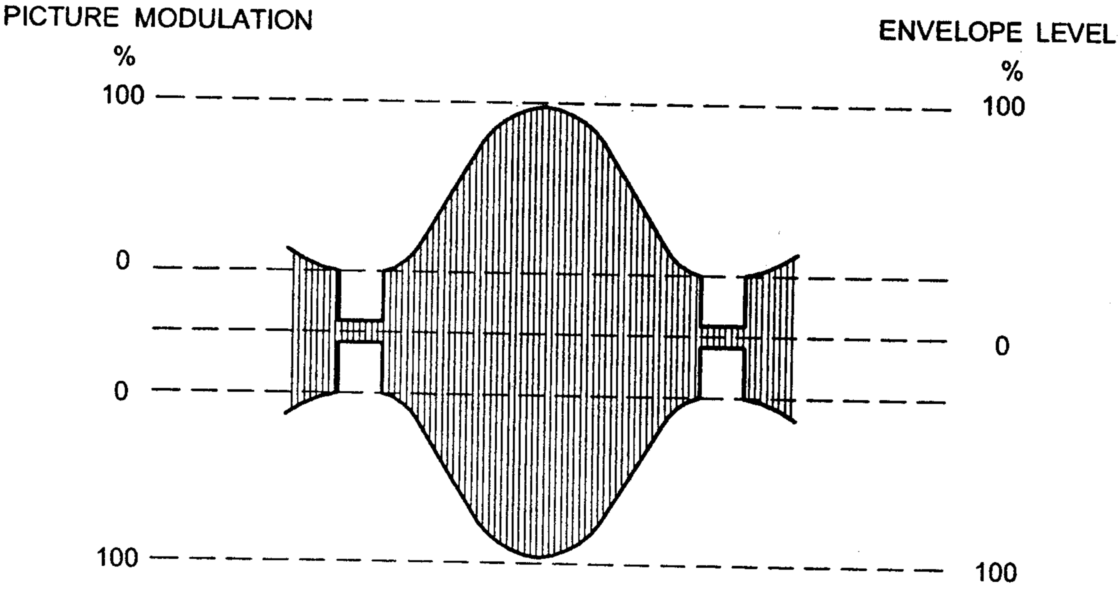
3.6 Brightness — This is the subjective impression of the luminance.

3.7 Supply Mains — This denotes any power source with an operating voltage of more than 24 V that is not used solely to supply television receivers.

3.8 Battery Operation — This denotes operation on



1A Modulated Radio Frequency Signal, Negative Modulation



1B Modulated Radio Frequency Signal, Positive Modulation

FIG. 1 PICTURE MODULATION PERCENTAGE

accumulator and/or dry batteries irrespective of the application of dc voltage transforming device.

3.9 Terminal Device — This denotes any device for connecting external conductors or apparatus.

3.10 Artificial Aerial — This denotes a network which replaces the receiving aerial and its associated transmission line when taking measurements.

3.11 Composite Video Signal — A composite video signal is a signal comprising the luminance, chrominance and the complete synchronizing information. It can also include digital data.

3.12 Television Signal — A television signal is a radio-frequency signal containing both vision and sound information in accordance with the standards of the television system used.

3.13 Test Patterns — A test pattern is used for checking the complete television system. It comprises a combination of monochrome or monochrome and colour signal components that offer as much information as possible on the performance of the system. Such a pattern shall include at least the following items:

a) Vertical and horizontal definition wedges in the centre and in the four corners of the picture area, calibrated in number of lines. The wedges shall enable definition to be checked up to the theoretical maximum of the system. The definition is always referred to the corresponding number of horizontal scanning lines, the same figure indicating the same definition, both vertically and horizontally. The video frequency corresponding to each number of lines may be calculated for the television system used.

b) Patterns for linearity and colour registration or convergence checks, consisting of a pattern of equidistant horizontal and vertical lines and/or dots. Circles may be included to facilitate adjustment of picture size and geometry.

c) A marking to check the aspect ratio.

d) Marks to facilitate centering of the picture even when the mask partly cuts the corners.

e) A known brightness scale of 5 to 10 brightness steps for gradation checks.

f) Alternate black and white blocks at the vertical edges of the picture to check synchronizing quality. These may be combined with the linearity patterns, and the aspect ratio marking.

g) Special patterns, such as single vertical bars of different widths and suitable horizontal blocks giving black-white and white-black transitions, for checking overshoot, reflections (ghosts) and low frequency response.

h) Coloured areas to check decoding operation, colour transitions and luminance/chrominance time equalization.

j) Areas at white level and black level to check drive levels, beam current limiting and inter-carrier sound.

k) The mean brightness of the patterns shall correspond to a mean picture modulation percentage of approximately 50 percent.

3.14 Field — A field is that part of the picture which is scanned in the interval between two successive vertical synchronizing impulses.

3.15 Picture — A picture consists of two consecutive field (*see* **3.14**).

3.16 Chromaticity — The colour quality of a colour stimulus is definable by its chromaticity coordinates or by its dominant (or complementary) wave length and its purity taken together.

3.17 Colour Bar Signals — Colour bar signals are electronically generated patterns and usually consist of vertical bands of colours in order of descending luminance, left to right.

NOTE — The following types of colour bar signals are recommended 100/0/75/0 and 75/0/75/0.

3.18 Hanover Blind Effect — This denotes spurious variation in luminance level, hue or saturation in the reproduced picture signal, line by line due to effects associated with the chrominance signal.

3.19 Unacceptable Performance — Performance may be considered unacceptable when one or more of the following phenomena occur:

a) Loss of synchronization,

b) Cross-modulation of sound and picture,

c) Loss of resolution,

d) Distortion of grey scale,

e) Noise effects in picture or sound,

f) Errors of colour reproduction,

g) Spurious colour effects,

h) Spurious interlined differences,

j) Spurious colour killing, and

k) Sound distortion.

3.20 Types of Receivers — Television receivers are usually designed to be capable of receiving broadcast and similar signals in a variety of ways. Examples are direct off-air reception or *via* a cable network in the VHF/UHF bands, and from satellite broadcast in conjunction with an outdoor unit and a DBS tuner. The signal may also include digital information, such as teletext.

For non-broadcast signals, the receiver may be used as a monitor to display prerecorded video or home movies. The equipment providing such information may modulate the signals on an RF carrier for connection to the antenna terminal, or provide baseband signals or both.

General purpose television receivers are usually designed for all the external signals. They may also include a DBS tuner/decoder and decoders for data information signals. Or, the receiver may be provided with outlets to permit use as a tuner.

The methods of measurements described in this standard take account of the various options.

3.21 Peripheral Connectors — Most receives are provided with connectors for the interface with audio and video signals other than those at radio frequencies.

4 GENERAL CONDITIONS OF MEASUREMENTS

4.1 Introduction

All measurements shall, unless specified otherwise; be carried out under the conditions specified in the relevant parts whilst the following points shall also be taken into consideration.

In all measurements on a television receiver, it is assumed that both the sound and the picture sections are operating, so that any influence one section may have on the other will be present during the measurements, except where otherwise stated. For instance, an A.G.C. circuit operated by the vision signal may influence the sound channel circuits and the reverse may be the case. One of the signals may be omitted from the composite television input signal only when it has been ascertained that this does not affect the results of the measurement in question.

For most measurements, it is important that the scanning circuits be properly synchronized.

4.1.1 *Operation Conditions*

Unless otherwise specified in the relevant clauses, the receiver under test shall be brought under the standard measuring conditions, as specified in **4.2**.

4.2 Standard Measuring Conditions

Unless otherwise specified, the standard conditions described below shall be applied.

4.2.1 *Standard Input Signal Level*

4.2.1.1 *Standard r.f. input signal level*

The standard input level of an r.f. television signal at the antenna terminal shall be 70dB (μV) when terminated with a 75 Ω resistor. This value corresponds to an available power of –39dB (mW).

If the receiver is equipped with a built-in antenna and without an antenna terminal, an r.f. television signal shall be applied by one of the methods specified in **11.3.** (The standard field strength when using the radiating antenna method of the TEM device method is under consideration.)

4.2.1.2 *Standard baseband input signal levels*

The input voltage of each video signal shall have the following values at the baseband signal input terminal:

a) Composite signal : 1 V_{p-p} for a white reference signal including synchronizing signals.

b) Y/C component signals Y: 1 V_{p-p} for a white reference signal including synchronizing signals, C: 0.66 $V0_{p-p}$ for PAL system.

c) R.G. B component signals : 0.7 V_{p-p} for a white reference signal without synchronizing signals.

The standard input voltage of the audio voltage of the audio signal of a sound channel shall be 500 $mV_{r.m.s.}$ at the audio signal input terminal at 1 kHz.

4.2.2 *Standard Output Signal Level*

4.2.2.1 *Standard video output voltages*

4.2.2.1.1 *Output voltage for a display device*

An output voltage for a display device shall be measured at the drive ports of the device and expressed as the peak-to-peak voltage corresponding to the difference between the white level and the black level, excluding synchronizing and blanking components.

The standard output voltage for a display device is defined as the output voltage at the luminance or G primary drive port when a reference pattern signal containing reference white and black levels is applied and the contrast and brightness are adjusted to obtain the following luminance values when ambient illumination is not present:

a) White level : 80 cd/m^2

b) Black level : 2 cd/m^2

If such luminance values cannot be obtained, the output voltage of the test pattern signal at the contrast and brightness settings specified in **4.2.3.3** shall be used and the actual luminance values at these settings shall be stated with the results.

The reference pattern signal shall contain a white reference part at the centre of the pattern and have an APL of 50 percent. The three vertical bar signal specified in **9.1.3** satisfies these requirements, but other test signals can be used if they meet the requirements.

The luminance of the white shall be measured at a small area of the centre with a luminance meter.

NOTES

1 In the case of CRT display, the drive ports are the CRT electrodes. In the case of an LCD display, however, they are input terminals to the driver of the LCD panels.

2 Luminance of a screen is not uniform on the entire screen and it tends to decrease at the fringe. It is not desirable to use (100/0/75/0) colour bar signal for the luminance measurements, since the white part is not located at the centre of the pattern.

3 It is necessary to specify the APL value of the test pattern, since the luminance of the white may vary with the APL in the receivers.

4.2.2.1.2 *Output voltages at the baseband signal output terminals*

The output voltage of each signal at the baseband signal output terminal, if adjustable, should be equal to the value indicated in **4.2.1.2**.

4.2.2.2 *Standard audio output signal levels*

4.2.2.2.1 *Output power for a loudspeaker*

The standard output power of an audio channel shall be a power 10 dB lower than the rated output power at 1 kHz, when terminated with a resistor equal to the impedance of the loudspeaker measured at 1 kHz.

4.2.2.2.2 *Output voltages at the baseband signal output terminals*

The standard output voltage of the audio signal of a sound channel, if adjustable, should be 500 mV r.m.s. at the baseband signal output terminal measured at 1kHz when terminated with the rated impedance.

4.2.3 *Standard Receiver Settings*

4.2.3.1 *Input signal levels*

The standard levels specified in **4.2.1** shall be used.

When an r.f. television signal is used, the carriers are modulated in accordance with **9**.

4.2.3.2 *Tuning*

When tuning of the receiver is adjustable, it shall be set to obtain the best picture quality for the composite test pattern and the audio output with minimum distortion and noise for a 1 kHz audio signal.

When a receiver is tuned by means of a frequency synthesizer, the preferred tuning method will be the nominal channel tuning.

NOTE — If this tuning method is different from that giving the best picture quality, it should be indicated with the results.

4.2.3.3 *Contrast and brightness of the picture*

Contrast and brightness controls shall be set to their normal positions when these are recommended or preset by the manufacturer. If such positions are not given, the contrast and brightness shall be adjusted using the composite test pattern for optimum picture quality and the settings shall be stated with the results.

The contrast setting and the video output voltage for the display under these conditions are defined as normal contrast setting and normal brightness setting respectively.

4.2.3.4 *Video output control*

The video output control for the base band output terminals, if provided, shall be set at the level specified in **10**.

4.2.3.5 *Picture (quality enhancement) control or switch*

The picture (quality enhancement) control or switch, if provided, shall be set at the normal quality position.

4.2.3.6 *Colour (saturation) and hue controls*

The colour (saturation) and hue controls shall set at the normal positions. If such positions are not indicated these controls shall be set at the best picture quality with the colour bar signal specified in **9.1.2.4**.

4.2.3.7 *Synchronization control(s)*

The synchronization control(s), if provided, shall be set at the centre within the pull-in-range.

4.2.3.8 *Automatic gain control (AGC)*

The automatic gain control shall be adjusted at the original position set by the manufacturer.

4.2.3.9 *Automatic brightness control*

If provided, it shall be disabled.

4.2.3.10 *Audio controls*

If audio signal(s) are present, the audio controls shall be adjusted as follows:

a) Volume control of the audio channel(s) shall be set to obtain the standard audio output specified in **4.2.2.2**;

b) Tone control of the audio signal(s), if provided, shall be set to the mechanical centre or to obtain the flattest audio frequency response at the output; and

c) Balance control of the stereo sound, if provided, shall be set to obtain equal output for both the left and the right channels.

4.2.3.11 *Others*

Other user controls if provided, shall be set at the positions to obtain the best picture and sound. If internal adjustments such as focus, white balance, purity and convergene are necessary, these shall be set to obtain the best picture quality.

4.2.4 *Standard Viewing Conditions*

Unless otherwise specified, the following conditions shall be applied to the measurements utilizing subjective assessment:

a)	video test signal	composite pattern signal, colour bar signal or VIR signal (to be specified in each measurement item)
b)	luminance of the picture	white level at 80 cd/m^2 and black level at 2 cd/m^2, when measured with the three vertical bar signal without ambient illumination
c)	other settings	standard settings specified in **4.2.3**
d)	viewing distance	six times the vertical height of the picture
e)	illuminance of the test room	30 lx to 75 lx measured on a horizontal plane at the viewing distance, except for front projection type displays
f)	illuminance on the screen surface due to ambient illumination	30 lx to 75 lx when the screen is inactive, except for front projection type displays
g)	background behind the receiver	wall or curtain with white or grey colour
h)	number of observers	more than five experts
j)	subjective scale	the ITU-R five-point impairment scale or threshold of visibility
k)	score	mean score

NOTES

1 If it is not possible to set the luminance level at the white to those specified above, the actual value should be stated with the results.

2 If colour saturation is changed from that at the standard settings when the luminance is set as specified above, readjust the colour control to obtain the best saturation.

3 The illuminance levels in the room and on the screen used should be stated with the results.

4 The illuminance levels for front projection type displays should be set according to the manufacturers specified.

4.2.5 *General Conditions*

Unless otherwise specified, the following general conditions shall be applied:

a) before starting each measuring item, the receiver under test is set to the standard receiver settings specified in **4.2.3** at the rated power supply voltage;

b) sound carrier(s) and baseband audio signal(s) are not present unless required in the method of measurement; and

c) baseband input video signals are in a form of composite video signal or Y/C signal.

4.3 Test Room

Measurement shall be carried out in a room which is not subject to external interference from radio-frequency and low-frequency electromagnetic fields. If interference may affect the results the measurements shall be carried out in a screened room.

4.4 Presentation of Results

The results of measurement shall be listed in a table or presented graphically. However, the relationship between two or more quantities is often more clearly represented in a graph than in a table.

When the results of a point-by-point measurement for an individual sample are presented as a continuous curve in a graph, the measured points shall be clearly indicated. Extrapolated, theoretical or other information presented, but not based on direct measurements; shall be clearly distinguished from measured curves, for example, by another style of drawing. Linear or logarithmic scales are recommended for graphical presentation. Linear decibel scales are equivalent to logarithmic scales.

If deviations from the recommended method are adopted these shall be clearly stated with the results. When known, the accuracy of measuring instruments shall also be given.

5 ENVIRONMENTAL CONDITIONS

5.1 Standard Reference Conditions

If the quantities to be measured depend on temperature and/or air pressure and the law of dependence is known, the values are measured under the conditions given in **5.3** and, if necessary, corrected by calculation to the following reference values:

a) Temperature : + 20°C
b) Air pressure : 101 300 Pa

NOTE — No requirements for relative humidity are given here, because a correction by calculation is generally not possible.

5.2 Standard Reference Conditions

If the quantities to be measured depend on temperature, humidity and air pressure and the law of dependence is unknown, the measurements may be made, by mutual agreement, under the following conditions:

a) Temperature : 25 ± 1°C

b) Relative humidity : 48 to 52 percent
c) Air pressure : 86 000 Pa to 106 000 Pa

When the temperature of measurement differs from 20°C or such other temperature as may be prescribed in the relevant specification, suitable limits for the characteristic values shall be agreed to between the user and the manufacturer.

The test report shall give the actual values of temperature, relative humidity and air pressure during the measurements.

For large equipment or test rooms, where temperature, relative humidity and air pressure limits as indicated above are difficult to maintain, wider tolerances are allowed, subject to mutual agreement. The actual values shall be given in the test report.

5.3 Standard Testing Conditions

Measurements and mechanical tests are normally carried out at any existing combination of temperature, humidity and air pressure within the following limits:

a) Temperature : +15° to +35°C
b) Relative humidity : 45 to 75 percent
c) Air pressure : 86 000 Pa to 106 000 Pa

In addition, for receivers intended for operation over a wider temperature range, such as portable and motor vehicle receivers, the temperature range may be extended further, covering one of the ranges specified in IS 9000 (Part l).

The temperature and relative humidity shall be substantially constant during the series of measurements carried out as a part of one test on one equipment.

Where it is impracticable to carry out measurements under these standard atmospheric conditions for testing, a note to this effect, stating the actual conditions, shall be added to the test report.

6 PRECAUTIONS DURING MEASUREMENTS

6.1 Damage to Equipment

When carrying out measurements on a receiver, all test conditions or operations which may lead to damage to the receiver and/or its tubes, valves or semiconductor devices, shall be avoided. This applies particularly to sensitive solid state devices such as integrated circuits and similar constructions.

6.2 Safety Arrangements

If a protecting cover is removed and parts which are directly connected to the mains (for example, the chassis) become accessible, it is recommended, for the safety of personnel performing measurements that equipment be connected to the ac mains *via* a safety transformer, the secondary winding of which is insulated in accordance with the principle of double insulation.

It shall be ascertained that the use of safety transformer does not influence the receiver properties to be measured. In particular, the internal impedance of the safety transformer shall be sufficiently low, for the behaviour of the receiver to be the same as when connected directly to the mains supply.

7 POWER SUPPLY

The following types of power supply are considered:

a) *Mains* — Any centralized ac or dc power sources;
b) *Batteries* — Accumulators, primary batteries, or similar sources such as solar batteries, thermo-electric cells etc; and
c) *ac adaptors* — Alternatives to normal dc. Voltage power sources and appropriately specified for the receiver.

The type, voltage and internal resistance of power sources used during measurements shall be either the power source specified for the receiver or closely simulate it. Any substitute arrangements used shall be stated with the results.

Receiver intended for use on more than one type of power supply should be measured with each type of power supply.

NOTE — In this respect ac mains and dc mains are considered different types of power supply.

Measurements of the receiver characteristics shall be carried out at the rated voltage of the power supply. The fluctuation of the power supply voltage during the test shall not exceed ± 2 percent. When ac mains are used, the frequency fluctuation and harmonic components of the power supply shall not exceed ± 2 percent and 5 percent respectively.

To determine the influence of variations in the supply voltages on the receiver characteristics, supplementary measurements may be needed at over voltages and under voltages, this being chosen appropriately with due regard to manufacturer's specification.

8 STABILIZATION PERIOD

In order to ensure that when measurements begin, the receiver characteristics are not changing significantly with time, the receiver shall be operated under standard measuring conditions for a sufficient period to permit the characteristics to stabilize.

9 TEST SIGNALS

9.1 Video Test Signals

Video test signals shall be electronically generated.

Waveforms of test signals and test patterns shown in this clause are example, other signals with similar characteristics may be used.

The amplitude of a picture component is measured from the blanking level and expressed as a percentage to the amplitude of the reference white level. Synchronizing tips correspond to –43 percent for PAL system.

All the composite signals which are used to judge colour or background colour shall be provided with the colour burst for the relevant system.

The white reference level can be obtained from composite test patterns (100/0/75/0) colour bar, split-field colour bar, three vertical bar and staircase signals, which are defined in this clause.

Test signals for measuring general properties of pictures include patterns for testing wide screen displays with 16 : 9 aspect ratio.

NOTES

1 The insertion test (ITS) signals defined by the recommendation ITU-R BT.473-5 can be applied for testing the luminance and chrominance channels.

2 In order to avoid excessive overshoots of the signal waveform which may occur in the television test modulator and the receiver under test, high-frequency components of the signal beyond 6 MHz should be attenuated by a suitable low-pass filter.

9.1.1 *Composite Test Pattern Signal*

A composite test pattern signal comprises a combination of monochrome and colour signal components that offer as much information as possible on the performance of the television system. Such a pattern should include at least the following items:

a) Circles, and equidistant horizontal and vertical lines for linearity and colour convergence checks;

b) A known brightness scale of brightness steps from five to ten for gradation checks;

c) Vertical and horizontal definition wedges in the centre and in the four corners of the picture area;

d) Vertical bars of different widths or a wedge and horizontal blocks giving black-white and white-black transitions for checking overshoot, reflections, and low-frequency response;

e) Areas at the reference white level and black level to check the maximum and minimum brightness of the picture; and

f) Coloured areas to check decoding operation, colour transitions and luminance/chrominance time equalization.

An average picture level (APL) of the pattern signal should be approximately 50 percent.

9.1.2 *Colour Bar Signal*

A colour bar signal consists of vertical bands of colours in order of descending luminance, left to right. The colour bar signal for PAL shall be a full-field type colour bar signal consisting of (100/0/75/0) bars.

The primary colour signal of the bars are shown in **Fig. 2.** The same bar arrangements can be used for wide aspect ratio pictures.

The composite colour signal of the bars shall comply with the television standard used.

Waveforms of the composite colour signals for PAL system is shown in Fig. 3.

9.1.3 *Three Vertical Bar Signal*

The three vertical bar signal produces three equidistant vertical white bars on a black background. The width of each bar is 1/6 times the nominal horizontal width (*W*) of the picture. A line-time waveform of the signal is shown in Fig. 4. This signal has an APL of 50 percent and includes the reference white level. It is suitable for setting the output signal level and the luminance level of white.

9.1.4 *White and Black Cross-Hatch Pattern Signals*

The white cross-hatch pattern signal produces a white cross-hatch on a black background and the black cross-hatch pattern signal produces a black cross-hatch on a white background.

The white cross-hatch pattern is used to measure convergence errors or registration errors of displays and the black cross-hatch pattern is used as a scale for locating a point on the screen and other purposes.

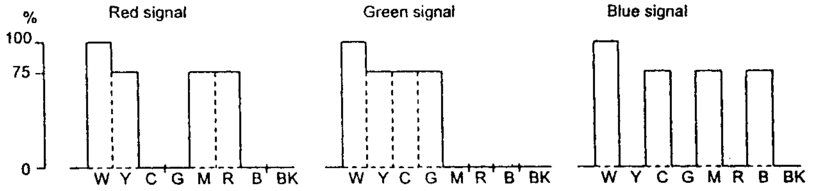
The cross-hatch pattern consists of equidistant horizontal and vertical lines which form rectangular windows. Numbers of the lines are 13 and 17 for the standard aspect ratio of 4 : 3, and 13 and 21 for the wide aspect ratio of 16 : 9, as shown in Fig. 5.

9.1.5 *Flat Level, Full White, Full Grey and Full Black Signals*

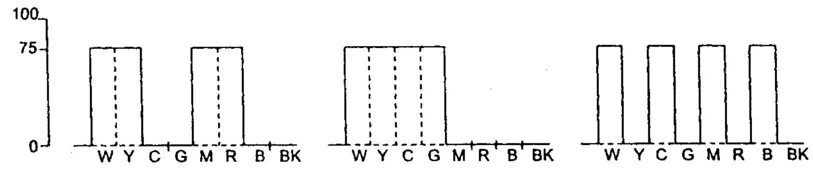
The flat level signal is a full-field flat amplitude signal, as shown in Fig. 6. The picture

amplitude is continuously variable from 0 percent to 100 percent.

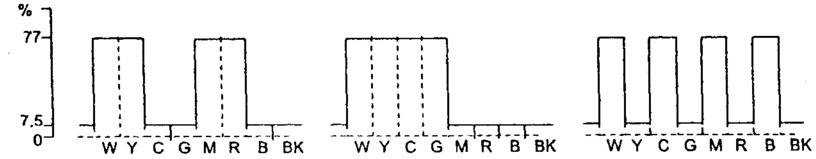
The full white, full grey and full black signal are flat level signals whose amplitudes are set at 100 percent, 50 percent and 0 percent respectively.



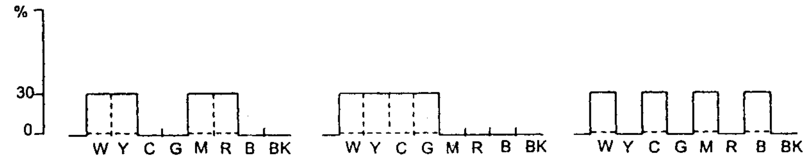
(100/0/75/0) colour bars



(75/0/75/0) colour bars



(77/7,5/77/7,5) colour bars



(30/0/30/0) colour bars

W: White, Y: Cyan, G: Green, M: Magenta R: Red, Bk: Blue

FIG. 2 PRIMARY COLOUR BAR SIGNALS

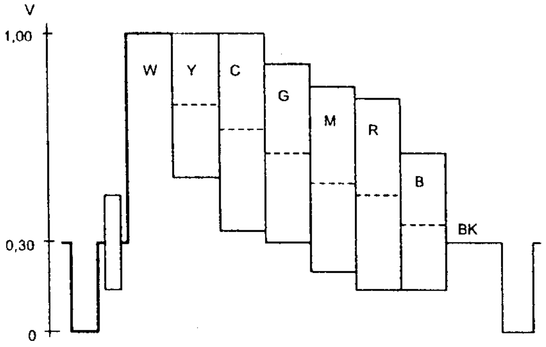
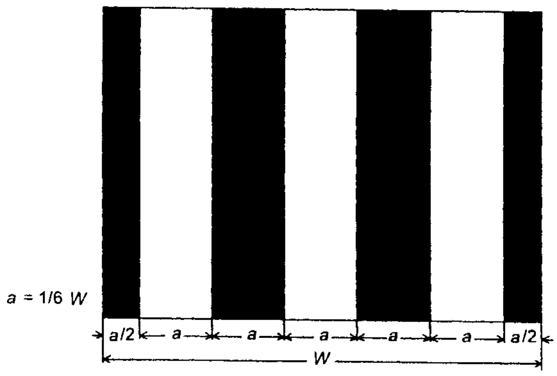
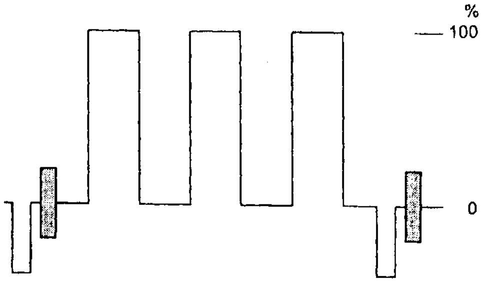


FIG. 3 PAL COLOUR BAR SIGNAL (100/0/75/0)

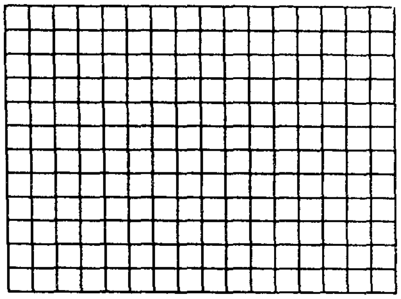


Bar pattern

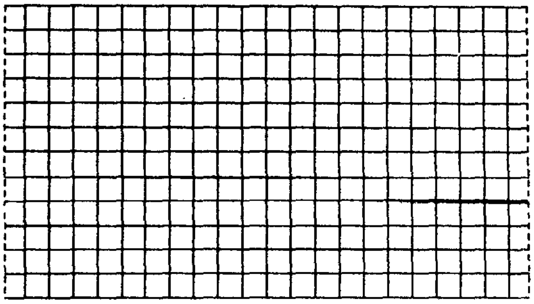


Signal waveform

FIG. 4 THREE VERTICAL BAR SIGNAL



5A Pattern for 4:3 aspect ratio



5B Pattern for 16:9 aspect ratio

FIG. 5 CROSS-HATCH SIGNALS

These signals are used to measure luminance and other characteristics of displays.

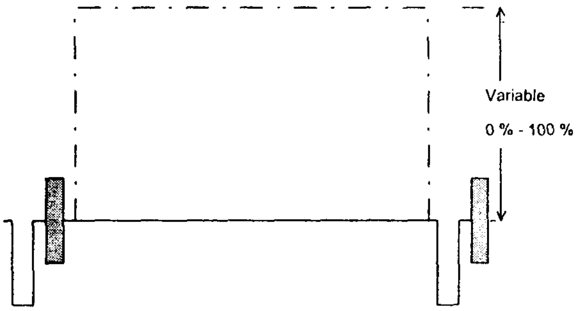


FIG. 6 FLAT LEVEL SIGNAL

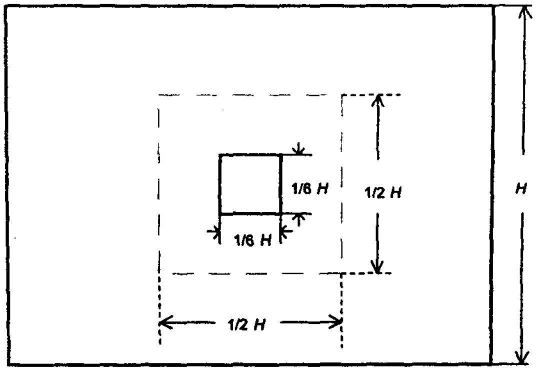
9.1.6 *White Window Signal and Wide White Window Signal*

The white window signal produces a white rectangular window on the black background, as shown in Fig. 7. The width of the window is 1/6 times the active picture height (*H*). The signal amplitude of the window is variable from 10 percent to 100 percent.

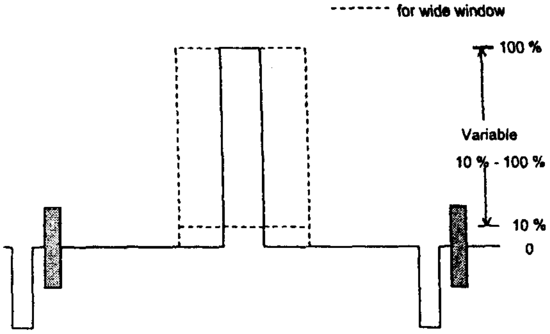
This signal is used to measure luminance of displays.

The wide white window signal produces a white rectangular window with a width of 1/2 times the nominal picture height and its amplitude is variable from 10 percent to 100 percent. This signal is not required, if the PLUGE signal is available.

The same windows can be applied for the test of wide screen displays, although the aspect ratio of the background has to be changed.



Window pattern



Signal waveform

FIG. 7 WHITE WINDOW SIGNAL

9.1.7 *Black and White Window Signal*

The black and white window signal produces a white rectangular window and four black rectangular windows on the 40 percent grey background, as shown in Fig. 8.

The size of the windows is the same as that of the white window signal.

This signal is used to measure contrast of displays.

The same windows can be applied for the test of wide screen displays, although the aspect ratio of the background has to be changed.

9.1.8 *Line and Window Signal*

The line and window signal consists of three vertical white lines placed at the centre and both sides of the picture and a window placed at the upper central part, as shown in Fig. 9. The background is set at the black level.

This signal is used to measure local picture distortion due to variation of the CRT beam current.

This pattern can be applied for the test of wide screen displays, although the aspect ratio of the pattern has to be changed.

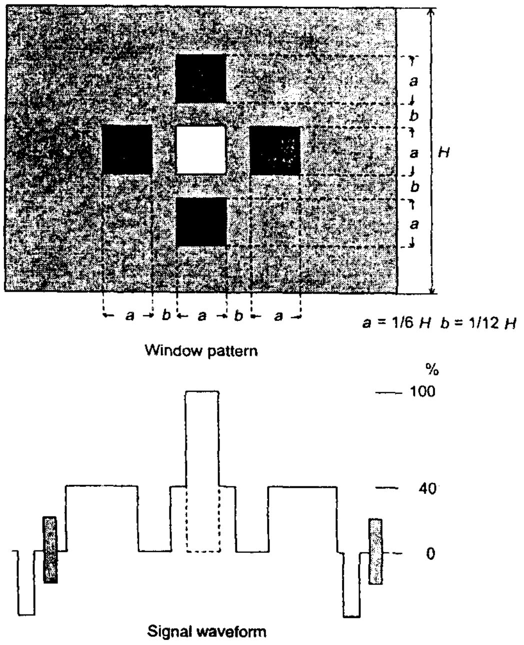


FIG. 8 BLACK AND WHITE WINDOW SIGNAL

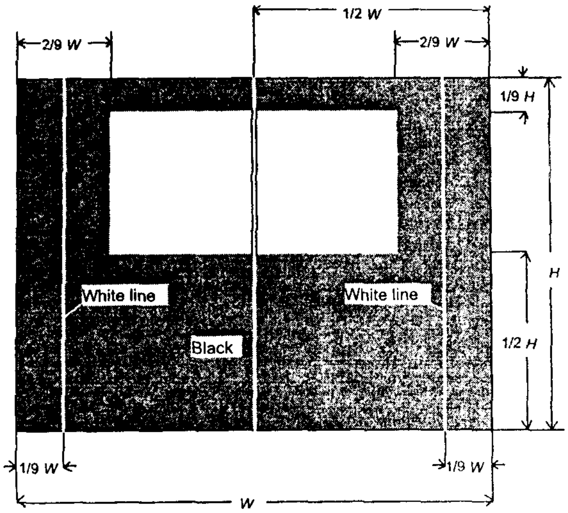


FIG. 9 LINE AND WINDOW SIGNAL

9.1.9 *Two-Step Signal*

A line-time waveform of the signal is shown in Fig. 10.

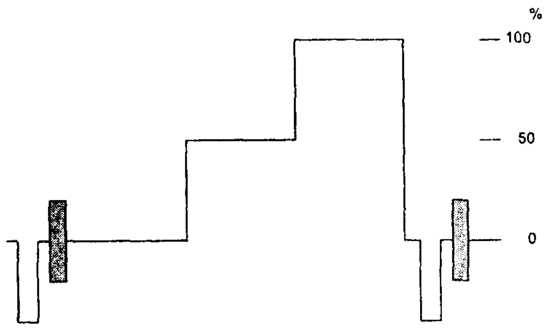


FIG. 10 TWO-STEP SIGNAL

This signal is used to measure gain- and noise-limited sensitivity.

9.1.10 *Composite Sine-Wave Signal*

The composite sine-wave signal consists of a variable-frequency sine-wave component superimposed on a grey signal with a peak-to-peak amplitude of 40 percent, as shown in Fig.11. The frequency of the sine-wave is variable from 100 kHz to 6 MHz and locked to the harmonics of the line frequency.

This signal is mainly used to measure amplitude-frequency response of the luminance channel and cross-colour measurements. In the measurements of the luminance channel at a frequency range of colour sub-carrier, the colour burst shall be switched off.

The amplitude of the sine-wave component is changed to 100 percent for the measurement of horizontal resolution.

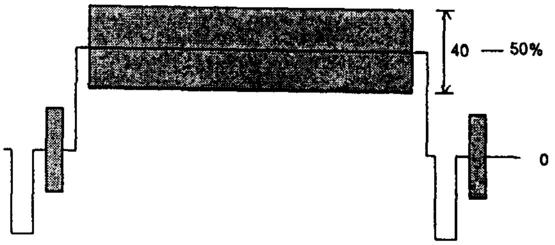


FIG. 11 COMPOSITE SINE-WAVE SIGNAL

9.1.11 *Multiburst Signal*

The multiburst signal comprises six bursts of discrete frequencies from 500 kHz to the limit of the system for which the receiver is intended. The signal starts with a four step reference with the values 0 percent, 25 percent, 50 percent and 75 percent. The frequency bursts having a peak-to-peak value of 50 percent are superimposed on a 50 percent luminance level. The colour bursts are not present. The signal waveform is shown in Fig. 12.

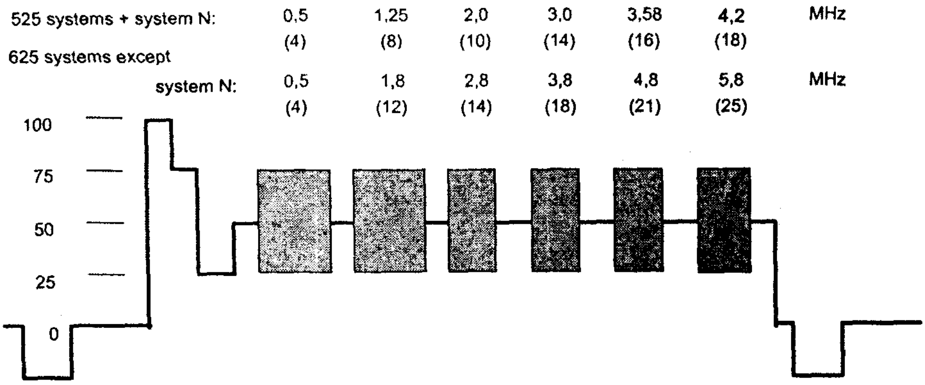
This signal is used to measure amplitude-frequency response of the luminance channel.

NOTE — Duration of the burst should be sufficiently long to contain at least four cycles.

9.1.12 *Multipulse Signal*

The multipulse signal is built up of modulated 20 *T* sine-squared pulses with high-frequency components at various frequencies in the pass band of the television system for which the receiver is designed, where T is the same definition as that for the 2 *T* pulse and bar signal. The colour bursts are not present.

The accuracy of the measurement at the lowest frequency can be improved, if a 40 *T* pulse is used


525 systems + system N: 0,5 (4) 1,25 (8) 2,0 (10) 3,0 (14) 3,58 (16) 4,2 (18) MHz
625 systems except system N: 0,5 (4) 1,8 (12) 2,8 (14) 3,8 (18) 4,8 (21) 5,8 (25) MHz
100
75
50
25
0

( ): minimum number of cycles

FIG. 12 MULTIBURST SIGNAL

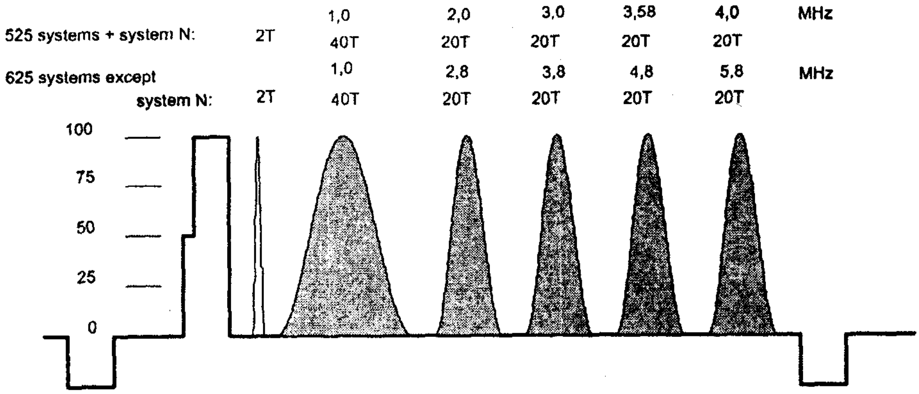

525 systems + system N: 2T 1,0 40T 2,0 20T 3,0 20T 3,58 20T 4,0 20T MHz
625 systems except system N: 2T 1,0 40T 2,8 20T 3,8 20T 4,8 20T 5,8 20T MHz
100
75
50
25
0

FIG. 13 MULTIPULSE SIGNAL

instead of the 20 *T* pulse. The same nomograph, as shown in figures 32 and 33 can be applied. However, the values stated in the nomograph must be multiplied by a factor 2.

The signal waveform is shown in Fig. 13.

This signal is used to measure group delay response of the luminance channel.

9.1.13 *2 T Pulse and Bar Signal*

The pulse and bar signal is composed of a sine-squared pulse and a sine-squared bar. The pulse width at the half amplitude and the rise time of the bar are equal to 2 *T* (*T* = 0.100 μs for the 625-line system excluding system N).

Duration of the bar is 5/32 *H* for the 625-line system measured at its half amplitude (*H*: duration of a line).

A line-time waveform of the signal is shown in Fig. 14. This signal is used to measure linear waveform response of the luminance channel.

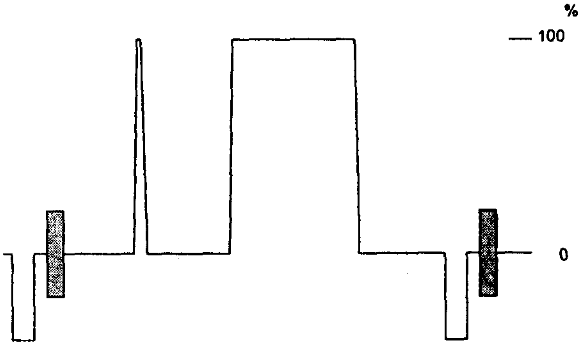
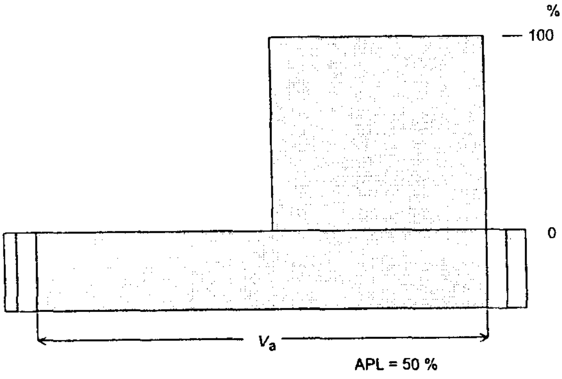


FIG. 14 2 *T* PULSE AND BAR SIGNAL

9.1.14 *Horizontal Bar Signal*

The horizontal bar signal produces a horizontal white bar, whose width is equal to one-half of the nominal picture height on the black background, as shown in Fig. 15.



V_a: active field period

FIG. 15 HORIZONTAL BAR SIGNAL

This signal is used to measure low-frequency square-wave response of the luminance channel.

9.1.15 *Staircase Signal and APL-Variable Staircase Signal*

Generally a staircase with five-riser is used as the test signal.

A line-time waveform of the five-riser signal is shown in Fig. 16A.

The APL-variable staircase signal is composed of the staircase signal of one line and flat level signals of four lines. The average picture level of the total signal can be adjusted in a range of 10 percent to 90 percent by varying the amplitude of the flat level signals from 0 percent to 100 percent. A waveform of the signal is shown in Fig. 16B.

This signal is used to measure line-time non-linearity of the luminance channel and of the display.

9.1.16 *PLUGE Signal*

The signal arranges three narrow black vertical stripes on the left-hand side and a four-riser grey scale bar on the right-hand side on the black background, as shown in Fig. 17. The levels of the left and right stripes are set at 2 percent below and 2 percent above the background level respectively. The level of the centre stripe is equal to the background level.

This signal is used to measure black level stability of the luminance channel and of the display.

9.1.17 *White PLUGE Signal*

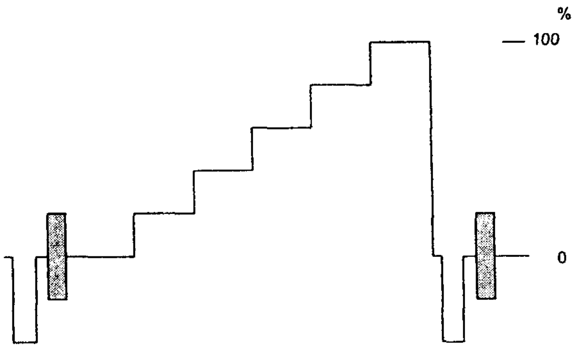
The left-hand side of the picture is the same as the PLUGE signal, the right-hand side consists of 100 percent peak white, as shown in Fig. 18.

The APL of the total picture is about 50 percent.

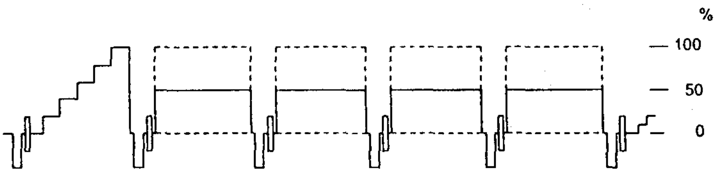
This signal is used to measure black level stability of the luminance channel and of the display.

9.1.18 *Colour Staircase Signal and APL-Variable Colour Staircase Signal*

The colour staircase signal is a staircase signal on which the colour sub-carrier is superimposed at an amplitude equal to that of the colour burst, as shown in Fig. 19.

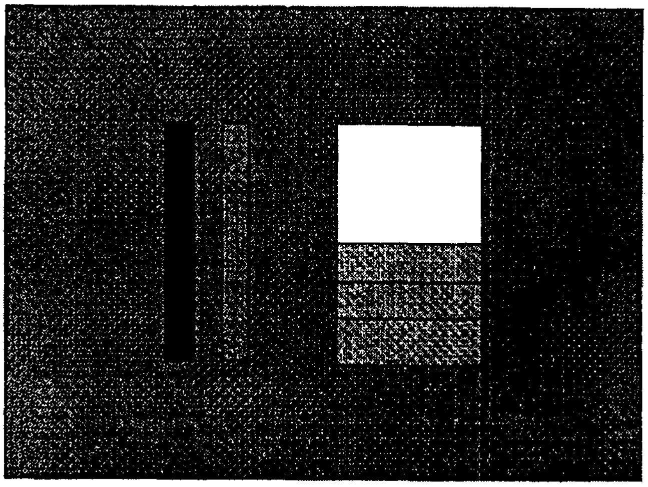


16A Five-Riser Staircase Singal

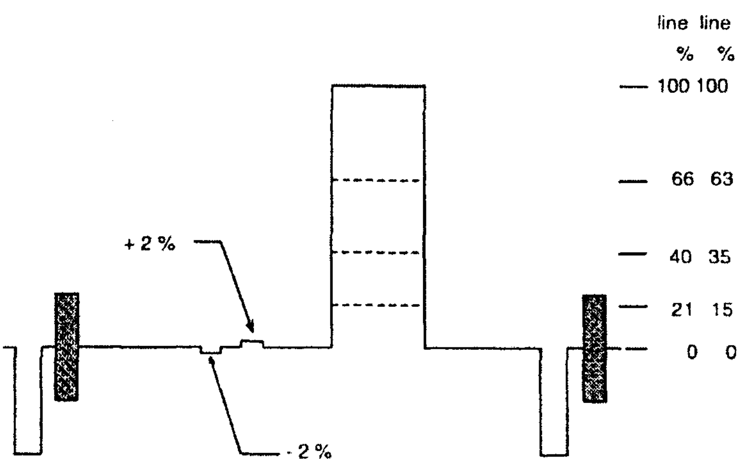


16B APL-Variable Staircase Signal

FIG. 16 STAIRCASE SIGNAL



PLUGE pattern



Signal waveform

FIG. 17 PLUGE SIGNAL

The APL-variable colour staircase signal is a colour staircase signal with APL variable function.

This signal is used to measure differential gain (DG) and differential phase (DP) of the composite signal at the baseband output terminal.

9.1.19 *Sine-Wave Modulated Chrominance Signal*

The sine-wave modulated chrominance signal is a sine-wave modulated subcarrier superimposed on a grey level, as shown in Fig. 20. The frequency of the sine-wave is variable from 20 kHz to 2 MHz.

For the NTSC and PAL systems, the colour is changeable to R-Y, B-Y and G-Y.

This signal is used to measure amplitude-frequency response of the chrominance channel.

9.1.20 *Modulated 20T Pulse and Bar Signals*

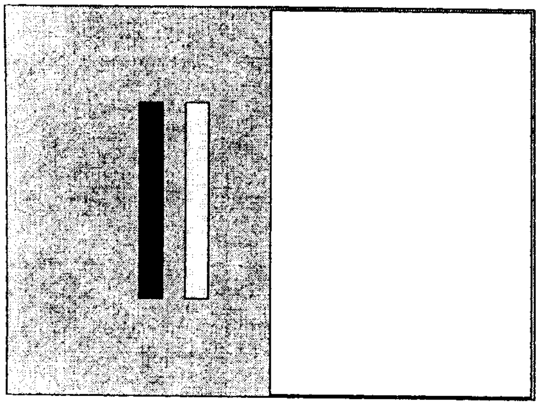
The modulated 20 *T* pulse and bar signal type A is a chrominance signal modulated with a 20 *T* pulse and a 20 *T* bar superimposed on a black background and the modulated 20 *T* pulse and bar signal type B consists of a 20 *T* pulse, a 20 *T* bar and a 50 percent Y signal, where *T* has the same definition as that for the 2 *T* pulse and bar signal. The width of the bar is the same as that defined for the 2 *T* pulse and bar signal. To avoid over ranging in the decoder, the sub-carrier in the signal B shall represent the green or magenta.

Line-time waveforms of the signals are shown in Fig. 21A and Fig. 21B.

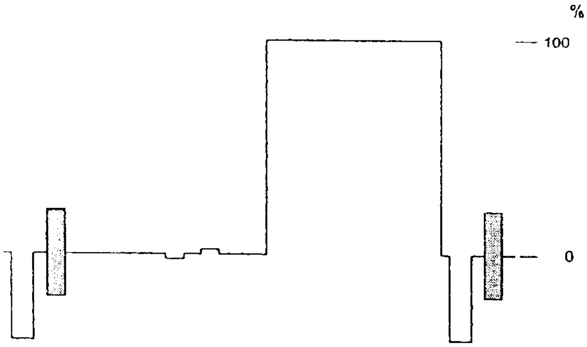
Signal A is used to measure group delay of a composite signal at the sub-carrier frequency while signal B is used to measure linear waveform response of the chrominance channel.

9.1.21 *Y/C Timing Test Signal*

This signal consists of three equal height horizontal bars, as shown in Fig. 22A.

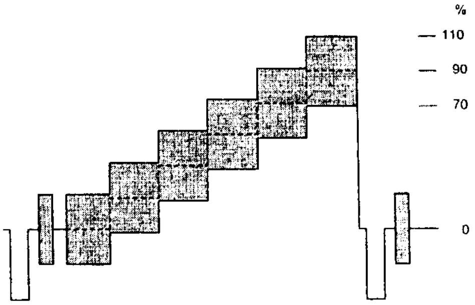


White PLUGE pattern

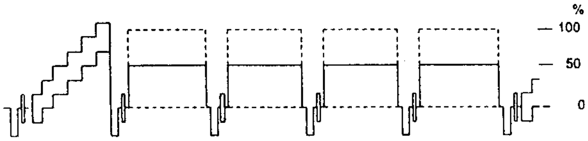


Signal waveform

FIG. 18 WHITE PLUGE SIGNAL



19A Colour Staircase Signal



19B APL-Variable Staircase Signal

FIG. 19 COLOUR STAIRCASE SIGNAL

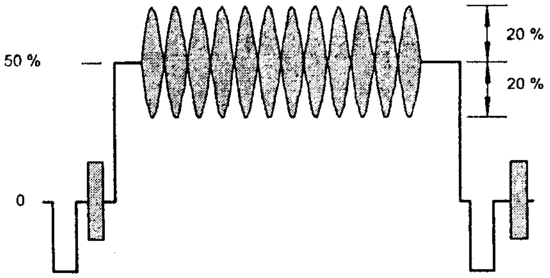
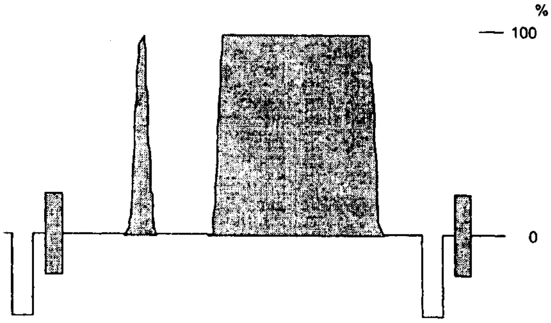
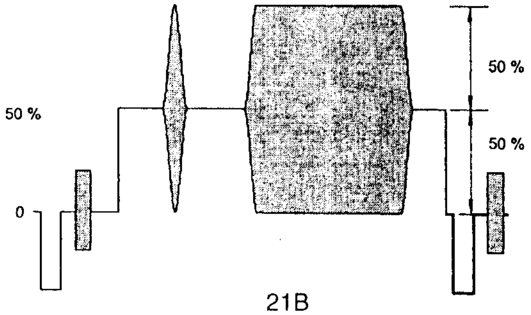


FIG. 20 SINE-WAVE MODULATED CHROMINANCE SIGNAL



21A



21B

FIG. 21 MODULATED 20 *T* PULSE AND BAR SIGNALS

The upper and lower bars of the pattern consist of colour difference signals corresponding to green and magenta on 50 percent constant luminance level. The width of the coloured bars is equal to those of the colour bar signal.

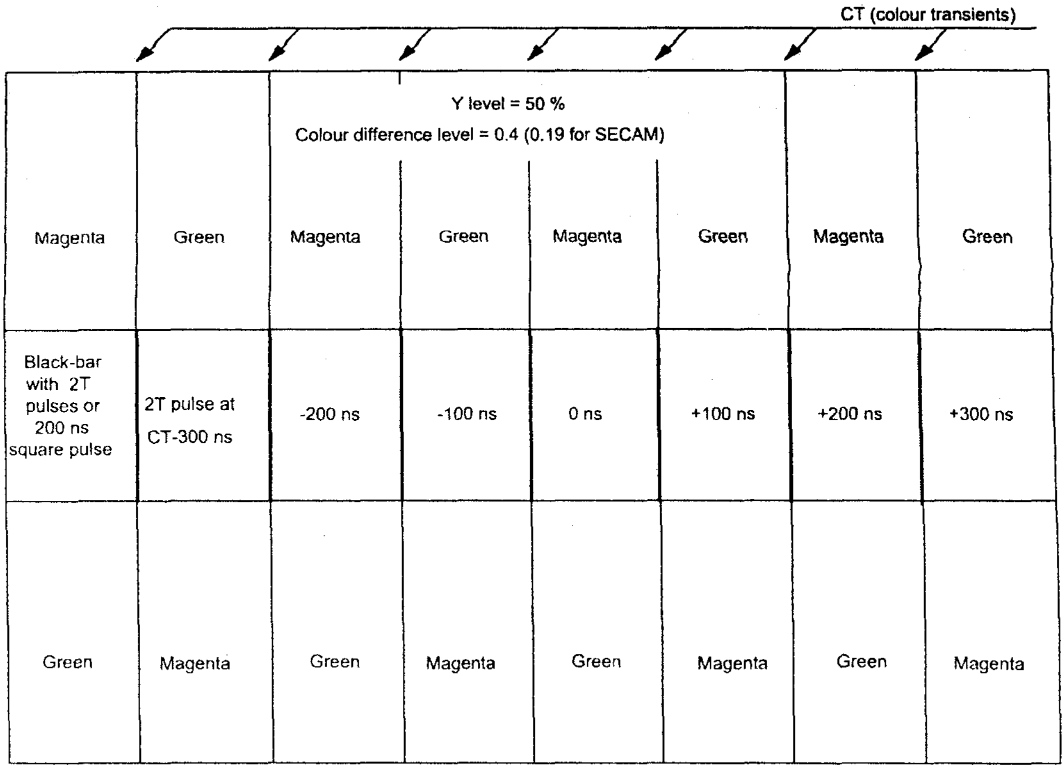
The centre bar consists of seven 2 *T* pulses on a black background level, as shown in Fig. 22B. The middle pulse coincides with the centre colour transient (0 ns). The first and the last pulses coincide respectively with – 300 ns and +300 ns, the second and the sixth ones with – 200 ns and +200 ns, and the third and the fifth ones with –100 ns and +100 ns.

The amplitude of the colour difference signals is equal to a value of ±40 percent for PAL systems.

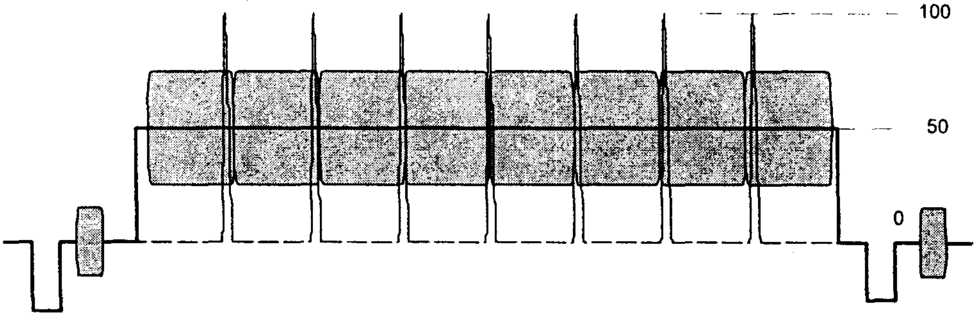
This signal is used to measure luminance/chrominance delay inequality of decoded colour signals.

9.1.22 *Staircase-Modulated Chrominance Signal*

The staircase-modulated chrominance signal is a staircase-modulated subcarrier superimposed on a flat level signal. The staircase has five-riser and the colour is changeable to each colour of the colour bars. The amplitude of the flat level signal and the maximum amplitude of the subcarrier are equal to the luminance



22A Y/C Timing Test Pattern



22B Signal Waveform

FIG. 22 Y/C TIMING TEST SIGNAL

and chrominance components of the colour bar at 75 percent saturation. A line-time waveform of the signal is shown in Fig. 23.

This signal is used to measure line-time non-linearity of the chrominance channel for NTSC and PAL receivers.

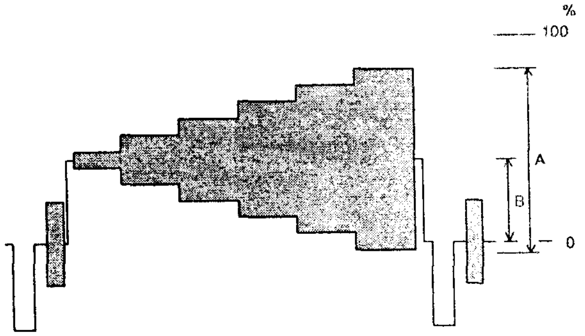


FIG. 23 STAIRCASE-MODULATED CHROMINANCE SIGNAL

9.1.23 *Modulated Pedestal Signal*

This signal consists of three modulated chrominance packets of different amplitude on a luminance level of 50 percent, as shown in Fig. 24. The peak-to-peak value of the packets are 20 percent, 40 percent and 80 percent of the peak white value. To avoid overload of R, G or B values in the colour encoder or decoder, the phase shall be in accordance with the magenta (60°, 68°).

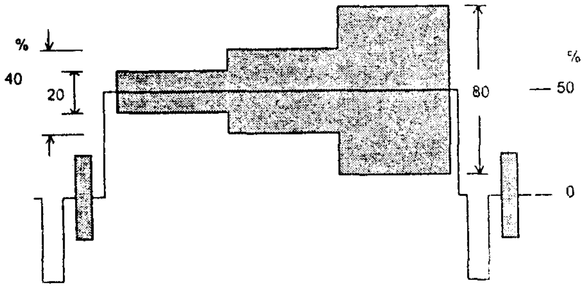


FIG. 24 MODULATED PEDESTAL SIGNAL

This signal is used to test chrominance to luminance intermodulation of PAL receivers.

9.1.24 *Single Colour Bar Signal*

The single colour bar signal produces a single vertical colour bar on the grey background. The width of the bar is set to about one-half of the active line scan period. The colour is set to B-Y or B.

The phase and amplitude of the colour burst is variable and the subcarrier frequency is also variable within ±1 000 Hz of the nominal subcarrier frequency.

A line-time waveform of the signal is shown in Fig. 25.

This signal is used to measure errors of demodulation angles of the chrominance signal and stability of colour synchronization in the NTSC and PAL decoders.

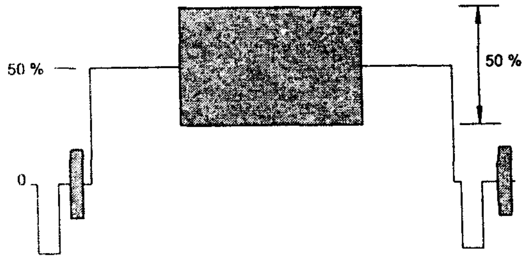


FIG. 25 SINGLE COLOUR BAR SIGNAL

9.1.25 *Four-Line Colour Difference Signal*

The four-line colour difference signal comprises colour difference signals of four lines superimposed on the 50 percent grey level. The picture is divided into clusters of 16 lines consisting of four colour difference, and 12 non-colour lines, as shown in Fig. 26.

This signal is used to measure errors of the demodulation angles of chrominance signals for the PAL system.

9.1.26 *Checkered Pattern Signal*

The checkered pattern comprises checkered patterns on the left and right sides and a vertical line in the middle, as shown in Fig. 27. The background of the pattern is set at a 25 percent grey level. The checker consists of black and white square blocks with a width of one-ninth the picture height.

This pattern is used to test the pulling on whites.

9.2 Audio Test Signals

a) 1 kHz sine-wave signal.
b) Frequency variable sine-wave signal.

Sine-wave signal in a frequency range of 50 Hz to 15 kHz.

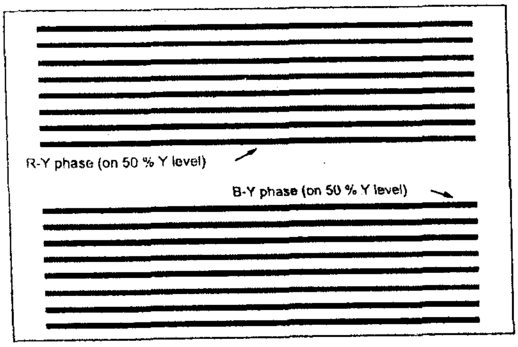
10 RADIO FREQUENCY (R.F.) TELEVISION SIGNAL

A television channel transmits a vision carrier and one or two sound carriers. In this standard, this group of the carriers is designated as radio frequency (r.f.) television signal.

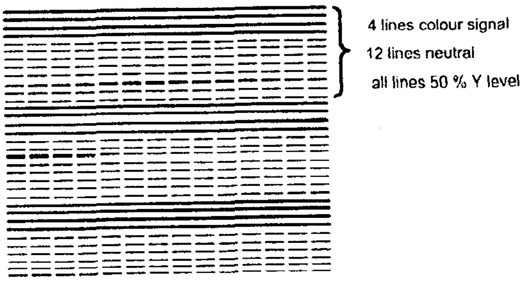
10.1 Carrier Levels

The level of a radio frequency television signal shall be expressed by the level of the modulated vision carrier in the signal.

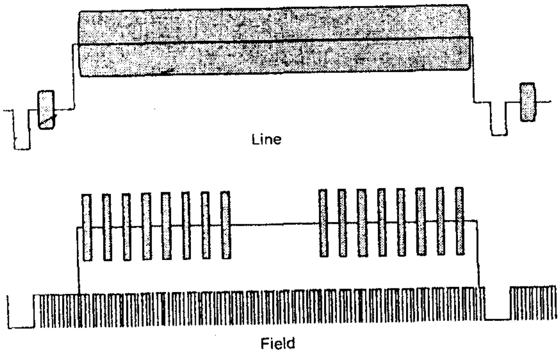
The level of a vision carrier shall be expressed as the r.m.s. value for the peak amplitude during the



26A Pattern



26B Detail fo Pattern



26C Signal Waveform

FIG. 26 FOUR-LINE COLOUR DIFFERENCE SIGNAL

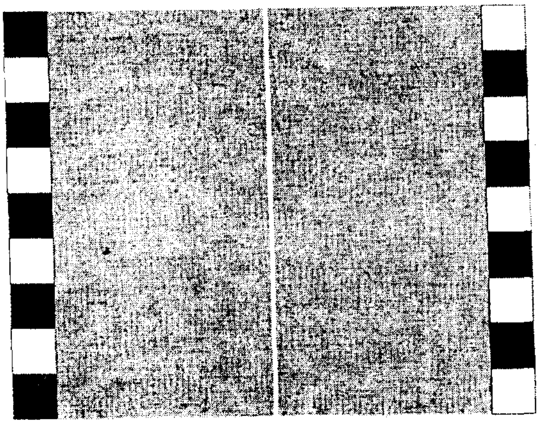


FIG. 27 CHECKERED PATTERN SIGNAL

synchronization pulses for negative modulation, and the r.m.s. value at the peak of a white reference signal for positive modulation.

Some of the measurements described in this standard require presence of modulated or unmodulated sound carrier(s) together with a vision carrier. In such cases, the sound carrier(s) shall be present at the power ratio(s) of the sound carrier(s) to the vision carrier defined by the television standard for which the receiver under test is designed. The level of a sound carrier shall be expressed as the r.m.s. value when modulation is not present.

10.2 Reference Modulation

Definition of modulation percentage of a vision carrier shall be in accordance with the television standard for which the receiver under test is designed.

Reference modulation percentage of a vision carrier shall be 100 percent when modulated with a white reference signal, as shown in Fig. 28.

If the television system provides multi-channel sound, the modulation shall be present in all the channels.

The following modulation levels shall be used as a reference for sound carrier(s):

10.2.1 *Monophonic Channel*

FM modulated sound carrier : 54 percent at 1 kHz

10.2.2 *Stereophonic Channel*

Both the left and right channels are modulated with a single sine-wave signal with the same polarity at the same level.

NICAM system: Full-scale minus 20 dB at 1 kHz.

10.3 Test Channels

Unless otherwise specified, tests shall be made on representative channels selected according to the following criteria:

a) *Band I* (*VHF*): Two channels, one at each edge of the band;

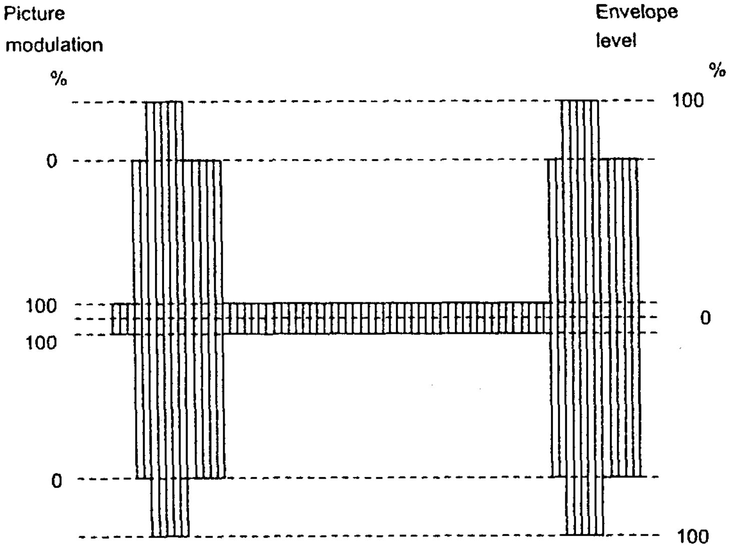
b) *Band III* (*VHF*): Two channels, one at each edge of the band;

c) *Band IV* (*UHF*): Two channels, one at the lower edge and one in the middle;

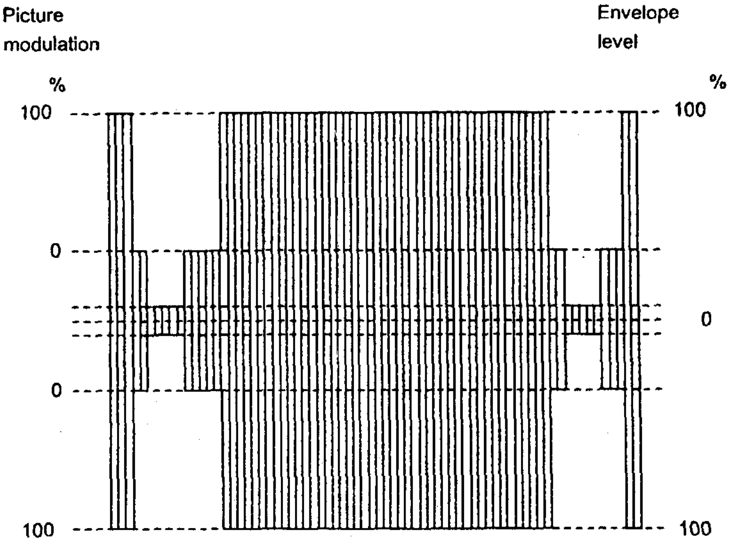
d) *Band V* (*UHF*): Three channels, two at the edges and one in the middle;

e) *Each band for cable television systems* (*VHF and UHF*): Two channels at the edges of each band and one in the middle.

For items whose characteristics are not affected by the frequency band, any one channel selected from the VHF and UHF bands can be used as typical channel.



Negative modulation



Positive modulation

FIG. 28 MODULATED RADIO FREQUENCY SIGNALS

11 RADIO FREQUENCY INPUT SIGNALS

11.1 Radio Frequency Input Signal Level

The radio frequency input level of the receiver shall be expressed as a terminal voltage. The terminal voltage is the voltage across the terminal of a generator when terminated with its specified terminal impedance.

In this standard, it is assumed that the input impedance of receivers is 75 Ω. If matching, balancing or combining networks are used, the terminal voltage is the voltage across the 75 Ω termination resistor of these networks.

For the receivers with input circuits for specified source impedance of 75 Ω, the input signal level shall be expressed in dB(μV) over 75 Ω. In the case of an r.f. television signal, the level shall be represented by the level of the vision carrier as defined in **9**.

To facilitate the direct comparison of receivers for which different source impedances are specified, it is useful to compare the input signal levels in terms of the power-equivalent terminal voltage at the output terminals of the generator including the corresponding matching, balancing or combining networks.

For receivers with input circuits specified for source impedance other than 75 Ω, the power-equivalent terminal voltage E' is the input voltage to the receiver delivering the same available power to the specified terminal: on resistor as E in the case of 75 Ω.

E' for RΩ can be calculated using the following formula:

$$E' = E + 10 \log_{10}(R/75)$$

where

E' = signal level across the resistance 2 W, in dB(mV);

E = signal level across 75 W, in dB(mV); and

R = impedance, in ohms.

Table 1 gives recommended values for the terminal voltage.

For the receivers with built-in antennas, the input signal shall be expressed in terms of field strength, in dB(μV/m).

For tests requiring the application of very low input signal levels, care shall be taken that interfering signals entering the receivers, in any spurious way, do not influence the results of the measurements.

11.2 Radio Frequency Input Arrangements

11.2.1 *Matching Network*

The specified source impedance R_r for which the receiver is designed, is not to be confused with actual input impedance of the receiver, as measurable at the antenna input terminals.

A receiver with an unbalanced or a balanced input circuit for a specified source impedance shall be measured with a signal source having respectively an unbalanced or a balanced output, whose internal impedance R_i is matched to the specified source impedance R_r.

If the specified source impedance R_r and the internal impedance of the signal source R_i are unequal, a suitable matching network shall be inserted between the signal source and the receiver.

Care shall be taken that connecting cables in the relevant parts of the circuit have characteristic impedance R_r or R_i, as appropriate.

If a balanced signal source is not available when needed, a suitable balancing network shall be used. Its influence on the signal shall be taken into account by calibrating the circuit fitted with the appropriate termination resistance before measurements.

11.2.2 *Combining Networks*

For the application of two or multi-signal measuring methods, suitable combining networks (combiners) shall be applied when coupling various signal sources.

A combining network may be followed by a balancing and/or a matching network according to its application.

The influence of the total network on the signal shall be taken into account by calibrating the circuit fitted with the appropriate terminal resistances.

11.3 Radio Frequency Input to Built-in Antennas

If the receiver under test has a built-in antenna but no antenna terminal, one of the methods described in **10.3.1** to **10.3.3** shall be used.

11.3.1 *Radiating Antenna Method*

The radiating antenna method defined in CISPR 13 shall be used except for the setting of the receiving antenna.

This method should preferably be used in an electromagnetic anechoic chamber in order to avoid interference due to ambient fields. Arrangement of the test equipment is shown in Fig. 29.

The height of the radiating antenna and direction of

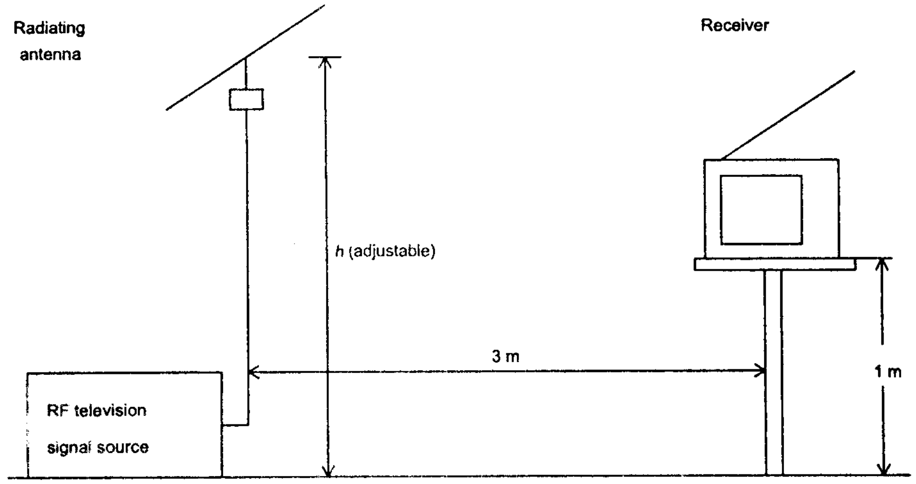


FIG. 29 MEASURING SET-UP FOR RADIATING ANTENNA METHOD

the built-in antenna shall be adjusted to obtain the best picture and the sound without noise and distortion. If both conditions cannot be met, the condition for the best picture shall be adopted.

It is preferable to operate the receiver by a battery, if it is designed for battery operation.

If this method cannot be used, the following subclauses provide means to apply r.f. input signal to the receiver under test in a less defined way or a limited frequency range.

11.3.2 *TEM (Strip Line) Device Method*

The TEM device defined in IS 12552 shall be used. Arrangement of the equipment is shown in Fig. 30.

11.3.3 *Coaxial Cable Method*

If accurate input signal levels or precise video-frequency characteristics are not required, an r.f. signal can be fed by a coaxial cable, connected directly to the bottom part of a monopole antenna, and through a balun for a dipole antenna.

In this method, the receiver shall be placed on a metallic plate larger than the area of the bottom of the receiver, and the inner conductor of the cable shall be connected to the antenna at the shortest length and the outer sheath of the cable shall also be connected to the plate.

12 MEASURING SYSTEM AND TEST INSTRUMENTS

12.1 Measuring System

A functional block diagram for the measuring system is shown in Fig. 31.

The r.f. interfering signal source is only required for measuring the maximum usable multiple r.f. input signal level and selectivity and immunity to undesired signals.

12.2 Baseband Test Signal Generators

12.2.1 *Video Test Signal Generator*

The video test signal generator shall be capable of generating the test signals specified in **3.2.1** in the form of composite video signals of the system for which the receiver under test is designed. An output level of 1 Vp-p across 75 Ω is required. In some measurements, the Y/C component signals or the R, G, B signals may also be required.

A video test signal generator with variable synchronizing frequency function is required for measuring synchronizing frequency ranges of receivers.

12.2.2 *Audio Test Signal Generator*

The audio test signal generator shall be capable of generating the test signals specified in **8.2.** An output level of 0.5 V r.m.s across 47 kΩ is required.

For testing the receivers with multi-channel sound, two or more signal outputs are required.

12.2.3 *Teletext Test Signal Generator*

The teletext test signal generator shall be capable of generating the test signals, and inserting them into the field blanking intervals of a video test signal at the level and intervals specified in the teletext standard for which the receiver under test is designed.

12.3 Television Test Modulator

The television test modulator shall be capable of modulating vision and sound carriers, and shall be capable of generating r.f. television signals specified in **9** at an output level of more than 110 dB(μV). For the multi-channel sound system, the sound encoder is required for modulation of the sound carrier(s). The output channels required are specified in **9.3**.

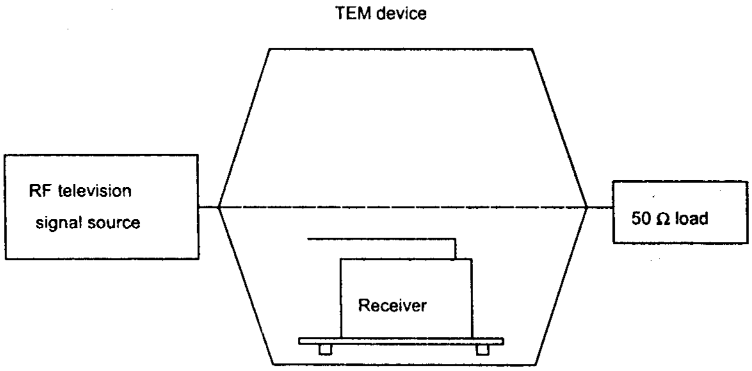


FIG. 30 MEASURING SET-UP FOR TEM DEVICE METHOD

Table 1 Recommended Values for Terminal Voltage

Input Signal Level in Terms of Terminal Voltage Across 75 Ω		Input Signal Level in Terms of Terminal Voltage Across 300 Ω
Recommended Values		
Preferred values dB(μV)	Intermediate values dB(μV)	Power equivalent terminal voltage dB(μV)
		21
	15	
		26
20		
		31
	25	
		36
30		
		41
	35	
		46
40		
		51
	45	
		56
50		
		61
	55	
		66
60		
		71
	65	
		76
70		
		81
	75	
		86
80		
		91
	85	
		96
90		
		101
	95	
		106
100		
		111
	105	
		116
110		
		121
	115	
		126

Additional video test signal generator(s) and modulator(s) are required for testing the maximum usable multiple r.f. input signal level and the immunity to undesired signals.

Special care shall be taken for the sideband filtering characteristics of the modulated vision carrier and spurious frequency components outside the channel when testing the selectivity and immunity to undesired signals. In addition to this, the group delay characteristics shall be pre-corrected for the receiver group delay characteristic.

Since most of the tests require the absence of the sound carrier(s), these shall be easily switched off.

For measuring the AFC characteristics of the local oscillator, a test signal generator with variable vision carrier frequency is required, although it does not need modulation characteristics as tight as those for other measurements. The carrier frequency should be variable within ±200 kHz of the nominal vision carrier frequencies.

12.4 R.F. Signal Generator

For testing the selectivity and response to undesired signals, one or two conventional AM signal generators, with a frequency range of 26 MHz to 1 GHz and with the maximum output level of more than 110 dB(μV), are required. They are also used as c.w. signal generators.

12.5 Spectrum Analyzer

The spectrum analyzer is used to measure the spectrum and levels of r.f. signals and video frequency components. If a digital frequency counting function is provided, it is also used for measuring the local oscillator frequencies. If not, a tuned r.f. amplifier and a frequency counter are required for measuring the local oscillator frequencies.

12.6 Video Noise Meter

The video noise meter shall be capable of measuring the r.m.s. level of random noise on the video signal. It shall have an unblanked video signal output in which the synchronizing signal components are eliminated.

It is necessary to use a low capacitance probe when measuring the signal and noise at the CRT electrodes.

12.7 Oscilloscope

A conventional oscilloscope covering the video frequency range can be used. It is, however, necessary to prepare a low capacitance probe when measuring the characteristics of the luminance and chrominance channels at the CRT electrodes.

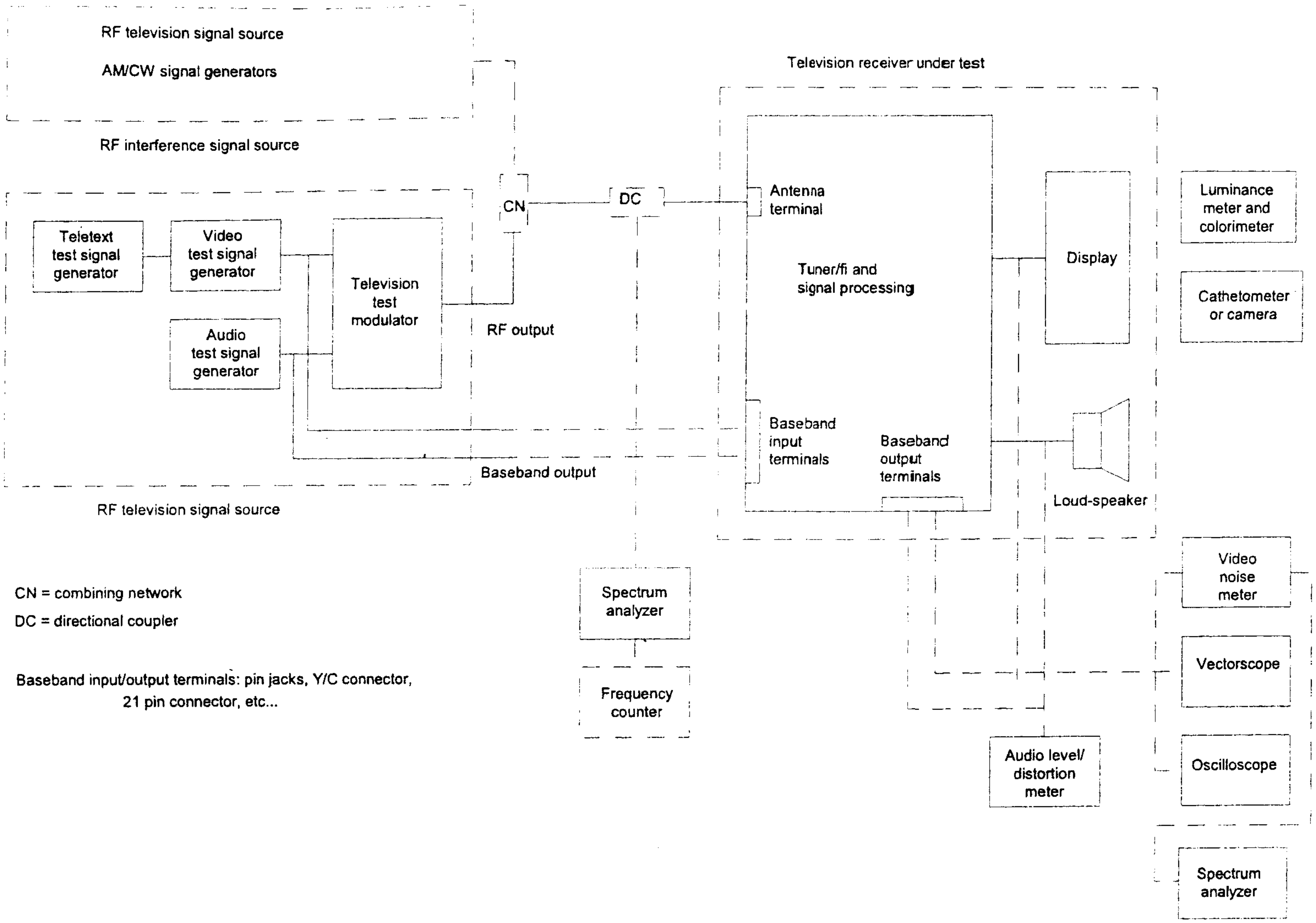
The oscilloscope is also used as an X-Y oscilloscope with d.c. coupling.

12.8 Vectorscope

The vectorscope is used for testing the characteristics of the chrominance channel and also for measuring differential gain (DG) and differential phase (DP) of composite signals at the baseband output.

12.9 Audio Level/Distortion Meter

A conventional audio measuring equipment can be used.


RF television signal source
AM/CW signal generators
RF interference signal source
Television receiver under test
Teletext test signal generator
Video test signal generator
Audio test signal generator
Television test modulator
RF output
Baseband output
RF television signal source
CN
DC
Antenna terminal
Tuner/fi and signal processing
Baseband input terminals
Baseband output terminals
Display
Loud-speaker
Luminance meter and colorimeter
Cathetometer or camera
Spectrum analyzer
Frequency counter
Video noise meter
Vectorscope
Oscilloscope
Audio level/ distortion meter
Spectrum analyzer

CN = combining network

DC = directional coupler

Baseband input/output terminals: pin jacks, Y/C connector, 21 pin connector, etc...

FIG. 31 FUNCTIONAL BLOCK DIAGRAM OF MEASURING SYSTEM

12.10 Passive Devices

Combining networks of two and three r.f. signals, a directional coupler and a VSWR bridge are required for testing the r.f. channel.

12.11 Luminance Meter and Colorimeter

The luminance meter (photometer) shall be capable of measuring the luminance of a small area on the screen within a range of 0.2 cd/m^2 to about 1 000 cd/m^2.

The colorimeter is capable of measuring the chromaticity of a small area on the screen as chromaticity coordinates (x, y) or (u', v') at a luminance level lower than 2 cd/m^2.

The area should be a circle with a diameter less than 4 percent of the screen width.

When measuring projection type displays and LCD displays, the luminance and chromaticity are measured at a location apart from the screen. For this purpose, the meters with a telescopic lens are required.

12.12 Other Optical Measuring Instruments

A sliding gauge or a cathetometer is required for measuring geometric distortion of the picture. When measuring viewing angles of projection and LCD displays, it is necessary to set the luminance meter on a stand with the scales of azimuth and elevation angles. When measuring a screen gain of a projector, an illuminance meter may be required.

13 INITIAL TESTS UNDER GENERAL OPERATING CONDITIONS

13.1 Electrical and Mechanical Performance

13.1.1 *Introduction*

These tests are carried out to verify that the receiver under test performs sufficiently well to justify further measurements described in later clauses of this standard.

If any unacceptable performance is found, further measurements should not be carried out. The following are examples of the phenomena which are considered to be unacceptable:

a) Loss of synchronization,
b) Cross-modulation of sound and picture,
c) Loss of resolution,
d) Distortion of grey scale,
e) Noise effects on picture or sound,
f) Errors of colour reproduction,
g) Spurious colour effects,
h) Spurious colour killing, and
j) Sound distortion.

13.1.2 *Methods of Measurement*

13.1.2.1 *Performance of user controls*

a) Apply the r.f. television signal of any channel modulated with programme signals or test signals in accordance with the television standard to the receiver at the standard input signal level, specified in **3.2.1**.
b) Check the picture and sound quality and also examine the electrical and mechanical performance and functions of user controls including remote controls at various control settings.
c) If baseband input terminals are provided, the test shall also be made for baseband input signals.

13.1.2.2 *Performance for input signal levels*

a) Apply the r.f. television signal of any channel modulated with the composite test pattern signal and 1 kHz audio signal(s) to the receiver at the standard input signal level and set the receiver to the standard settings specified in **3.2.3**.
b) Check the operation of the receiver at various r.f. input signal levels. If baseband output terminals are provided, levels and waveforms of the output signals shall also be checked.
c) If baseband input terminals are provided, the test shall also be made for the standard baseband input signals at levels of ±3 dB referred to the standard input levels.

13.1.2.3 *Performance of r.f. channel selection*

a) Apply the r.f. television signal of any channel modulated with the composite test pattern signal and 1 kHz audio signal(s) to the receiver at the standard input signal level and set the receiver to the standard settings according to **3.2.3**.
b) Check the function of channel selection by changing the channel of the r.f. television signal within the frequency bands for which the receiver is designed.

13.1.2.4 *Performance for multi-channel television signal source*

If the receiver is intended to be connected to a multi-channel television signal source such as a cabled distribution system, the tests described in **12.1.2.1** and/or **12.1.2.2** should also be made by using such a signal source.

13.1.2.5 *Influence of variations in power supply voltage*

Although measurements at the undervoltage and overvoltage are specified for the characteristics which may be sensitive to the variations of the power supply voltage, other characteristics may also be influenced by the variations. Therefore, the following test shall be carried out:

a) Vary the power supply voltage of the receiver within a range of the overvoltage and undervoltage and check the changes of performance such as loss of picture synchronization and colour synchronization, variation of the picture size, variation of the black level and shift of tuning; and
b) If such changes can be adjusted by the user controls, re-adjust them and repeat the test. If the normal performance cannot be obtained even when the re-adjustments are made or no user controls are provided, note the phenomena.

If necessary, make supplementary measurements for the relevant characteristics at the under and overvoltages of the power supply.

NOTE — The range of the variations are normally ± 10 percent of the rated voltage. If different values are specified by the manufacturer, apply such values.

13.2 Power Consumption

13.2.1 *Method of Measurement*

13.2.1.1 *Measuring conditions*

a) Power supply voltage and frequency — rated
b) Video test signal — three vertical bars signal
c) Audio test signal(s) — 1 kHz sine-wave signal(s)
d) Signal input — r.f. and/or baseband
e) Modulation of sound channel(s) — 100 percent
f) Input signal level — standard input signal level
g) Test channel for r.f. input — typical channel
h) Loading of terminals — loudspeaker terminals and baseband output terminals are terminated in accordance with **3.2.2.2**. Loading of any ancillary circuit is included but any peripheral equipment that is powered from the receiver is excluded.

13.2.1.2 *Measurement procedure*

a) Set the receiver under test to the standard settings and then adjust the contrast and brightness controls so as to obtain the luminance specified in **3.2.2**. The volume control of all the audio channels shall be set to obtain 50 mW at a 1 kHz single tone signal.
b) Measure power consumption of the receiver with an electrodynamic wattmeter or any other wattmeter of sufficient accuracy.

If the receiver is provided with the r.f. and baseband input terminals, the r.f. input shall be used.

If the receiver is provided with multi-channel sound, all the audio channels shall be set to obtain the output power specified above

If any ancillary circuits are included in the receiver, the power shall be measured with and without loading the circuits.

If the receiver is operated by a d.c. power supply, the power shall be calculated from the measurement of loading current at the rated supply voltage. If an ac. adaptor for the dc power supply is provided, the ac. power consumption shall also be measured.

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